Pipeline Failure Investigation Report

Pipeline System: Aberdeen Distribution System **Operator:** NorthWestern Energy

Operator ID: 31632 **Unit Number:** _____ **Activity Number:** _____

Location: 507 N 2nd St, Aberdeen, SD **Date of Occurrence:** 2/6/2018

Material Released: Natural gas **Quantity:** 5 MCF

PHMSA Arrival Time & Date: 1:15 pm 2/7/18 **Total Damages $:** $110,000

Investigation Responsibility: _x_ State __ PHMSA __ NTSB __Other _____

	Company Reported Apparent Cause:	*Company Reported Sub-Cause (from PHMSA Form 7000-1/7100.2):*
	Corrosion	
	Natural Force Damage	
	Excavation Damage	
x	Other Outside Force Damage	Other – Structural movement of building wall.
	Material Failure (Pipe, Joint, Weld)	
	Equipment Failure	
	Incorrect Operation	
	Other	

	Accident/Incident Resulted in (check all that apply):	*Comments:*
	Rupture	
x	Leak	
x	Fire	
x	Explosion	
x	Evacuation	Number of Persons:____2_____ Area: _____

Narrative Summary
Short summary of the Incident/Accident scenario
House was vacant at time of incident and being remodeled. There was an explosion and then a fire. Service was dug up and squeeze off was installed on the steel service approximately 30 feet from the house. During the fire the operator found no indication of gas leakage but were unable to get close to the house because of the fire. Because of the circumstances of having no leak indication outside the home it was initially expected to be cause by customer piping rather than the service line. Due to the extreme frost conditions it took some time to get the area exposed. At the riser, there was 2 levels of concrete. The top layer of concrete was approximately 4 inches thick and a second layer below the first layer was approximately 2 inches thick. The concrete was poured all the way to foundation of the house. There was no sleeve around the riser to allow for movement. The riser consisted of a 1" steel pipe with an reducing elbow fitting connecting to the 1 ¼" steel service line. The failure was at the point of connection of the riser pipe with the elbow. The break was at the threads.

Region/State: **Central / South Dakota** **Reviewed by:** _____

Principal Investigator: **Mary Zanter, Pipeline Safety Program Manager** **Title:** _____

Date: _____ **Date:** _____

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Failure Location & Response

Location (City, Township, Range, County/Parish): (Acquire Map)
Aberdeen, Brown County, SD

Address or M.P. on Pipeline: (1)	Type of Area (Rural, City): (1)
507 N 2nd St	**city**

Coordinates of failure location (Latitude): **45.470957** (Longitude): **-98.490929**

Date: **2/6/18**	Time of Failure: **10:14**
Time Detected: **10:14**	Time Located: **10:14**

How Located: **Explosion.**

NRC Report #: (Attach Report)	Time Reported to NRC:	Reported by:
1203737	**14:25**	**Devin McCarthy, NorthWestern Energy**

Type of Pipeline:

Gas Distribution	Gas Transmission	Hazardous Liquid	___ LNG
__ LP	__ Interstate Gas	__ Interstate Liquid	
__ Municipal	__ Intrastate Gas	__ Intrastate Liquid	
_x_ Public Utility	__ Gas Gathering	__ Offshore Liquid	
__ Master Meter	__ Offshore Gas	__ Liquid Gathering	
	__ Offshore Gas - High H_2S	__ CO_2	
		__ Low Stress Liquid	
		__ HVL	

Pipeline Configuration (Regulator Station, Pump Station, Pipeline, etc.): **Service line riser.**

Operator/Owner Information

Owner: **NorthWestern Corporation** Address: **3010 W 69th St.** **Sioux Falls, SD 57108** Company Official: **Mr. Curt Pohl, Vice President – Retail Operations** **NorthWestern Energy** **40 E. Broadway** **Butte, MT 59701-9394** **curtis.pohl@northwestern.com** Phone No.: **(406) 497-2119** Fax No.:	Operator: Address: Company Official: Phone No. Fax No.

1 Photo documentation

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Operator/Owner Information	
Drug and Alcohol Testing Program Contacts	__**x** N/A
Drug Program Contact & Phone:	
Alcohol Program Contact & Phone:	

Damages			
Product/Gas Loss or Spill[(2)]	**Natural gas**	Estimated Property Damage **$85,000**	
Amount Recovered	**None**	Associated Damages[(3)] **$ 26,650**	
Estimated Amount $	**$50**	(Total Damages of $110,650)	
Description of Property Damage: **Primary residence was total loss due to fire. Neighbor to south had some damage to the side of the house. Neighbor to the north had some damage to the side of the house.**			
Customers out of Service:	_**x**_ Yes	__ No	Number: **1**
Suppliers out of Service:	__ Yes	_**x**_ No	Number:

Fatalities and Injuries					_*x*__ *N/A*
Fatalities:	__ Yes	_**x**_ No	Company:	Contractor:	Public:
Injuries - Hospitalization:	__ Yes	_**x**_ No	Company:	Contractor:	Public:
Injuries - Non-Hospitalization:	__ Yes	_**x**_ No	Company:	Contractor:	Public:
Total Injuries (including Non-Hospitalization):			Company:	Contractor:	Public:

Name	Job Function	Yrs. w/ Comp.	Yrs. Exp.	Type of Injury

Drug/Alcohol Testing	_*x*__ *N/A*
Were all employees that could have contributed to the incident, post-accident tested within the 2 hour time frame for alcohol or the 32 hour time frame for all other drugs? **NA** ___Yes ___No	

Job Function	Test Date & Time	Location	Results		Type of Drug
			Pos	Neg	

2 Initial volume lost or spilled
3 Including cleanup cost

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System Description
Describe the Operator's System: **1 ¼" steel service line connected to main in the alley. Service was installed in 1956. Service was joined with couplings. The riser consisted of a 1 x 1 ¼ inch reducing elbow connected to a 1" steel riser pipe.**

Pipe Failure Description	*___ N/A*
Length of Failure (inches, feet, miles): **Single break at coupling to riser pipe connection.** (1)	
Position (Top, Bottom, include position on pipe, 6 O'clock): (1) **Circumferential**	Description of Failure (Corrosion Gouge, Seam Split): (1) **Sheer break.**
Laboratory Analysis: ___ Yes _x__ No Performed by:	
Preservation of Failed Section or Component: __x_Yes ___No If Yes - Method:	
In Custody of: **NorthWestern Energy**	
Develop a sketch of the area including distances from roads, houses, stress inducing factors, pipe configurations, direction of flow, etc. Bar Hole Test Survey Plot, if included, should be outlined with concentrations at test points.	

Component Failure Description		*___ N/A*
Component Failed:	**Reducing coupling** (1)	
Manufacturer:	Model:	
Pressure Rating:	Size: **1 1/4" x 1"**	
Other (Breakout Tank, Underground Storage):		

Pipe Data	*___ N/A*
Material: **Steel**	Wall Thickness/SDR: **0.156**
Diameter (O.D.): 1" x 1 ¼"	Installation Date: **1956**
SMYS:	Manufacturer:
Longitudinal Seam:	Type of Coating:
Pipe Specifications (API 5L, ASTM A53, etc.):	

Joining	*___N/A*
Type: **Threaded**	Procedure: **pre-code**
NDT Method: **NA**	Inspected: ___ Yes __**x**_No

Pressure @ Time of Failure @ Failure Site	*__x_ N/A*
Pressure @ Failure Site: **23 psig**	Elevation @ Failure Site:

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Pressure @ Time of Failure @ Failure Site				***__x_ N/A***
Pressure Readings @ Various Locations:			Direction from Failure Site	
Location/M.P./Station #	Pressure (psig)	Elevation (ft msl)	Upstream	Downstream

Upstream Pump Station Data	***_x__ N/A***
Type of Product:	API Gravity:
Specific Gravity:	Flow Rate:
Pressure @ Time of Failure [4]	Distance to Failure Site:
High Pressure Set Point:	Low Pressure Set Point:

Upstream Compressor Station Data	***_x__ N/A***
Specific Gravity:	Flow Rate:
Pressure @ Time of Failure [0]	Distance to Failure Site:
High Pressure Set Point:	Low Pressure Set Point:

Operating Pressure	***___ N/A***
Max. Allowable Operating Pressure: **25 psig**	Determination of MAOP: **Service installed pre-code. MAOP was 25 psig per operating history.**
Actual Operating Pressure: **approx.. 23 psig**	
Method of Over Pressure Protection: **regulator station**	
Relief Valve Set Point:	Capacity Adequate? __x_ Yes ___ No

Integrity Test After Failure	***___ N/A***
Pressure test conducted in place? (Conducted on Failed Components or Associated Piping): __x_ Yes ___ No	
If No, tested after removal? ___ Yes ___ No	
Method: **air test to operating pressure of 23 psig**	
Describe any failures during the test.	

Soil/water Conditions @ Failure Site	***___ N/A***
Condition of and Type of Soil around Failure Site (Color, Wet, Dry, Frost Depth): **Frost was at a depth of approximately 3 feet.**	
Type of Backfill (Size and Description): **black dirt with a very small amount of clay**	

4 Obtain event logs and pressure recording charts

Pipeline Failure Investigation Report

Soil/water Conditions @ Failure Site	***___ N/A***
Type of Water (Salt, Brackish):	Water Analysis [5] ___ Yes ___ No

External Pipe or Component Examination	***___ N/A***
External Corrosion? ___Yes **_x__** No [1]	**Coating Condition (Disbonded, Non-existent):** [1]
Description of Corrosion:	
Description of Failure Surface (Gouges, Arc Burns, Wrinkle Bends, Cracks, Stress Cracks, Chevrons, Fracture Mode, Point of Origin):	
Above Ground: ___ Yes **_x__** No [1]	Buried: **__x_** Yes ___ No [1]
Stress Inducing Factors: **concrete around riser** [1]	Depth of Cover: **approx. 2 feet** [1]

Cathodic Protection	***_x__ N/A***
P/S (Surface):	P/S (Interface):
Soil Resistivity: pH:	Date of Installation:
Method of Protection:	
Did the Operator have knowledge of Corrosion before the Incident? ____ Yes ____ No	
How Discovered? (Close Interval Survey, Instrumented Pig, Annual Survey, Rectifier Readings, ECDA, etc):	

Internal Pipe or Component Examination	***__x_ N/A***
Internal Corrosion: ___ Yes ___No [1]	Injected Inhibitors: ___ Yes ___ No
Type of Inhibitors:	Testing: ___ Yes ___ No
Results (Coupon Test, Corrosion Resistance Probe):	
Description of Failure Surface (MIC, Pitting, Wall Thinning, Chevrons, Fracture Mode, Point of Origin):	
Cleaning Pig Program: ___ Yes ___ No	Gas and/or Liquid Analysis: ___ Yes ___ No

5 Attach copy of water analysis report

Pipeline Failure Investigation Report

Internal Pipe or Component Examination	***__x_ N/A***
Results of Gas and/or Liquid Analysis [6]	
Internal Inspection Survey: ___ Yes ___ No	Results [7]
Did the Operator have knowledge of Corrosion before the Incident? ___ Yes ___ No	
How Discovered? (Instrumented Pig, Coupon Testing, ICDA, etc.):	

Outside Force Damage	***_x__ N/A***
Responsible Party:	Telephone No.:
Address:	
Work Being Performed:	
Equipment Involved: [1]	Called One Call System? ___ Yes ___ No
One Call Name:	One Call Report # [8]
Notice Date:	Time:
Response Date:	Time:
Details of Response:	
Was Location Marked According to Procedures? ___ Yes ___ No	
Pipeline Marking Type: [1]	Location: [1]
State Law Damage Prevention Program Followed? ___ Yes ___ No ___ No State Law	
Notice Required: ___Yes ___No	Response Required: ___ Yes ___ No
Was Operator Member of State One Call? ___ Yes ___ No	Was Operator on Site? ___ Yes ___ No
Did a deficiency in the Public Awareness Program contribute to the accident? ___Yes ___ No	
Is OSHA Notification Required? ___ Yes ___ No	

Natural Forces	***__ N/A***
Description (Earthquake, Tornado, Flooding, Erosion): **Movement of earth/foundation at riser.**	

6 Attach copy of gas and/or liquid analysis report
7 Attach copy of internal inspection survey report
8 Attach copy of one-call report

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Natural Forces	***__ N/A***

Failure Isolation	***__ N/A***
Squeeze Off/Stopple Location and Method: **Steel service line was squeezed off and capped. The service was then retired at the main.** (1)	
Valve Closed - Upstream: Time:	I.D.: M.P.:
Valve Closed - Downstream: Time:	I.D.: M.P.:
Pipeline Shutdown Method: __ Manual __ Automatic __ SCADA __ Controller __ ESD	
Failed Section Bypassed or Isolated:	
Performed By:	Valve Spacing:

Odorization	***__ N/A***
Gas Odorized: _x_ Yes __ No	Concentration of Odorant (Post Incident at Failure Site): **.15**
Method of Determination: __ Yes __ No **Sniff test with Heath Odorator**	% LEL: _x_ Yes __ No | % Gas In Air: _x_ Yes __ No Time Taken: __ Yes __ No **11:28 am**
Was Odorizer Working Prior to the Incident? _x_ Yes __ No	Type of Odorizer (Wick, By-Pass): **Injection**
Odorant Manufacturer: Model:	Type of Odorant: **Spotleak 1009, Manufactured by Odortech**
Amount Injected:	Monitoring Interval (Weekly): **monthly**
Odorization History (Leaks Complaints, Low Odorant Levels, Monitoring Locations, Distances from Failure Site): **NA**	

Weather Conditions	***__ N/A***
Temperature: **approx.. -10 degrees F**	Wind (Direction & Speed): **approx. 10 mph from North**
Climate (Snow, Rain): **snow on ground**	Humidity:
Was Incident preceded by a rapid weather change? __ Yes **x**__ No	
Weather Conditions Prior to Incident (Cloud Cover, Ceiling Heights, Snow, Rain, Fog): **Typical winter weather.**	

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Gas Migration Survey	***__ N/A***
Bar Hole Test of Area: _x_ Yes __ No	Equipment Used:
Method of Survey (Foundations, Curbs, Manholes, Driveways, Mains, Services) [9] [1] Bar Hole area with CGI, also used RMLD. See attached map.	

Environment Sensitivity Impact	***_x_ N/A***
Location (Nearest Rivers, Body of Water, Marshlands, Wildlife Refuge, City Water Supplies that could be or were affected by the medium loss): [1]	
OPA Contingency Plan Available? __ Yes __ No	Followed? __ Yes __ No

Class Location/High Consequence Area	_x_ N/A
Class Location: 1 __ 2__ 3 __ 4 __ Determination:	HCA Area? __ Yes __ No __ N/A Determination:
Odorization Required? __ Yes __ No __ N/A	

Pressure Test History **__ N/A**
(Expand List as Necessary)

	Req'd [10] Assessment Deadline Date	Test Date	Test Medium	Pressure (psig)	Duration (hrs)	% SMYS
Installation	N/A					
Next						
Next						
Most Recent						

Describe any problems experienced during the pressure tests.
Service installed pre-code. MAOP was 25 psig per operating history.

Internal Line Inspection/Other Assessment History **_x_ N/A**
(Expand List as Necessary)

	Req'd [10] Assessment Deadline Date	Assessment Date	Type of ILI Tool [11]	Other Assessment Method [12]	Indicated Anomaly If yes, describe below
Initial					__ Yes __ No
Next					__ Yes __ No
Next					__ Yes __ No
Most Recent					__ Yes __ No

9 Plot on site description page
10 As required of Pipeline Integrity Management regulations in 49CFR Parts 192 and 195
11 MFL, TFI, UT, Combination, Geometry, etc.
12 ECDA, ICDA, SCCDA, "other technology," etc.

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Internal Line Inspection/Other Assessment History *(Expand List as Necessary)*	***_x_ N/A***
Describe any previously indicated anomalies at the failed pipe, and any subsequent pipe inspections (anomaly digs) and remedial actions.	

Pre-Failure Conditions and Actions	***_x_ N/A***
Was there a known pre-failure condition requiring [10] the operator to schedule evaluation and remediation? __ Yes (describe below or on attachment) _x_ No	
If there was such a known pre-failure condition, had the operator established and adhered to a required [10] evaluation and remediation schedule? Describe below or on attachment. __ Yes _x_ No __ N/A	
Prior to the failure, had the operator performed the required [10] actions to address the threats that are now known to be related to the cause of this failure? _x_ Yes __ No __ N/A List below or on an attachment such operator-identified threats, and operator actions taken prior to the accident.	
Describe any previously indicated anomalies at the failed pipe, and any subsequent pipe inspections (anomaly digs) and remedial actions.	

Maps & Records	***___ N/A***
Are Maps and Records Current? [13] **__x** Yes __ No Comments:	

Leak Survey History	***__x_ N/A***
Leak Survey History (Trend Analysis, Leak Plots):	

Pipeline Operation History	***_x__ N/A***
Description (Repair or Leak Reports, Exposed Pipe Reports):	
Did a Safety Related Condition Exist Prior to Failure? ___ Yes ___ No Reported? ___ Yes ___ No	
Unaccounted For Gas:	
Over & Short/Line Balance (24 hr., Weekly, Monthly/Trend):	

13 Obtain copies of maps and records

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Operator/Contractor Error	***__x_ N/A***
Name:	Job Function:
Title:	Years of Experience:
Training (Type of Training, Background):	
Was the person "Operator Qualified" as applicable to a precursor abnormal operating condition? ___Yes ___ No ___ N/A	
Was qualified individual suspended from performing covered task ___ Yes ___ No ___ N/A	
Type of Error (Inadvertent Operation of a Valve):	
Procedures that are required:	
Actions that were taken:	
Pre-Job Meeting (Construction, Maintenance, Blow Down, Purging, Isolation):	
Prevention of Accidental Ignition (Tag & Lock Out, Hot Weld Permit):	
Procedures conducted for Accidental Ignition:	
Was a Company Inspector on the Job? ___ Yes ___ No	
Was an Inspection conducted on this portion of the job? ___ Yes ___ No	
Additional Actions (Contributing factors may include number of hours at work prior to failure or time of day work being conducted):	
Training Procedures:	
Operation Procedures:	
Controller Activities:	

Name	Title	Years Experience	Hours on Duty Prior to Failure	Shift

Alarm Parameters:
High/Low Pressure Shutdown:
Flow Rate:
Procedures for Clearing Alarms:
Type of Alarm:
Company Response Procedures for Abnormal Operations:

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Operator/Contractor Error	***__x_ N/A***
Over/Short Line Balance Procedures:	
Frequency of Over/Short Line Balance:	
Additional Actions:	

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Additional Actions Taken by the Operator	***_x__N/A***
Make notes regarding the emergency and Failure Investigation Procedures (Pressure reduction, Reinforced Squeeze Off, Clean Up, Use of Evacuators, Line Purging, closing Additional Valves, Double Block and Bleed, Continue Operating downstream Pumps):	

Photo Documentation [(1)]			
Overall Area from best possible view. Pictures from the four points of the compass. Failed Component, Operator Action, Damages in Area, Address Markings, etc.			
Photo No.	Description	Photo No.	Description
1		16	
2		17	
3		18	
4		19	
5		20	
6		21	
7		22	
8		23	
9		24	
10		25	
11		26	
12		27	
13		28	
14		29	
15		30	
Camera Type:			

Additional Information Sources			
Agency	Name	Title	Phone Number
Police:			
Fire Dept.:			
State Fire Marshall:			
State Agency:			
NTSB:			
EPA:			
USCG:			
FBI:			
ATF:			
OSHA:			
Insurance Co.:			
FRA:			
MMS:			
Television:			
Newspaper:			
Other:			

Persons Interviewed		
Name	Title	Phone Number

Event Log	
Sequence of events prior, during, and after the incident by time. (Consider the events of all parties involved in the incident, Fire Department and Police reports, Operator Logs and other government agencies.)	
Time / Date	Event

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Investigation Contact Log			
Time	Date	Name	Description

Failure Investigation Documentation Log					
Operator:		Unit #:	CPF #:		Date:
Appendix Number	Documentation Description			Date Received	FOIA Yes	FOIA No

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Site Description
Provide a sketch of the area including distances from roads, houses, stress inducing factors, pipe configurations, etc. Bar Hole Test Survey Plot should be outlined with concentrations at test points. Photos should be taken from all angles with each photo documented. Additional areas may be needed in any area of this guideline.